

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

Inventors: Arjang Fartash **Examiner:** Michael Lavilla
Application No: 10/825,841 **Group Art Unit:** 1775
Filing Date: April 15, 2004 **Confirmation No:** 9435
Title: METHOD OF MAKING A TANTALUM LAYER AND APPARATUS USING A
TANTALUM LAYER

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APPEAL BRIEF UNDER 37 CFR §41.37

APPELLANT'S/APPLICANT'S OPENING BRIEF ON APPEAL

TO THE ASSISTANT COMMISSIONER FOR PATENTS:

Sir:

This Brief is submitted in support of the Appeal in the above-identified application.

1. REAL PARTY IN INTEREST

The real party in interest is Hewlett-Packard Development Company, LP, a limited partnership established under the laws of the State of Texas and having a principal place of business at 20555 S.H. 249 Houston, TX 77070, U.S.A. (hereinafter "HPDC"). HPDC is a Texas limited partnership and is a wholly-owned

affiliate of Hewlett-Packard Company, a Delaware Corporation, headquartered in Palo Alto, CA. The general or managing partner of HPDC is HPQ Holdings, LLC.

2. RELATED APPEALS AND INTERFERENCES

Appellant, Appellant's legal representative, and Assignee are unaware of any other appeals or interferences which would directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

3. STATUS OF THE CLAIMS

Claims 1-53 and 57-61 are pending in the application. Claim 49 is allowed. Claims 2, 11, 13-14, 18, 20-28, 30, 33, 35-36, 38-43, 45-48, and 51-53. are objected to as being dependent upon a rejected base claim. Claims 1, 3-10, 12, 15-17, 19, 29, 31-32 34, 37, 44, 50, and 57-61 stand finally rejected by the Examiner and are being appealed herewith.

4. STATUS OF AMENDMENTS

No amendments have been made subsequent to the Office Communication dated 23 February 2007.

5. SUMMARY OF CLAIMED SUBJECT MATTER

Appellant's invention is directed to various apparatuses utilizing tantalum films. The present invention provides a method of fabricating a wide variety of devices that include bcc-phase or alpha tantalum structures incorporated into the device where both phases have a residual compressive stress. In addition, the present invention also provides a method of forming a single sheet of tantalum in which the structural phase of tantalum is laterally switched (i.e. "switching-phase-

tantalum") between α -phase tantalum and β -phase tantalum at length scales in the nanometer range. Further, alpha or bcc-phase tantalum has a thermal conductivity an order of magnitude higher than β -phase tantalum, thus, the present invention provides a convenient method of generating surface temperature gradients by spatially controlling the phase of tantalum deposited over lateral length scales in the nanometer range. Paragraph 8 of the specification

A. Independent claim 1

Independent claim 1 recites a method of making a tantalum structure, comprising: creating (194) a tantalum layer (230, 330, 430, 530) disposed on a first layer region (224, 324, 524) of a first layer (222) and on a second layer region of a second layer (220, 348, 425, 525), wherein said tantalum layer is a substantially bcc-phase tantalum region (234, 334, 434, 534) on said first layer region and said tantalum layer is a non-bcc-phase tantalum region (232, 332, 432, 532) on said second layer region. Paragraphs 10-12, 16-17, and 27-28.

B. Independent claim 50

Independent claim 50 recites an apparatus, comprising: a substrate (220, 320, 420, 520); a tantalum layer (230, 330, 430, 530) disposed over said substrate; and a bcc-phase-tantalum forming seed region (224, 324, 524) disposed between said substrate and said tantalum layer, said bcc-phase-tantalum forming seed region in contact with said tantalum layer, wherein said tantalum layer forms a substantially bcc-phase tantalum region (234, 334, 434, 534) where said tantalum layer is in contact with said bcc-phase-tantalum forming seed region, and wherein said tantalum layer forms a non-bcc-phase tantalum region (232, 332, 432, 532) where said tantalum layer is not in contact with said bcc-phase tantalum forming seed region. Paragraphs 10-12, 16-17, and 27-28.

C. Independent claim 57

Independent claim 57 recites an apparatus, comprising: a substrate (220, 320, 420, 520); and means for generating a difference in thermal conductivity laterally within an essentially uniformly thick tantalum layer (230, 330, 430, 530) disposed over said substrate. Paragraphs 8, 21, and 25.

6. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

A. Claims 57-61 do not fail to comply with the written description requirement under 35 U.S.C. §112, first paragraph.

B. Claims 57-61 are not indefinite under 35 U.S.C. §112, second paragraph.

C. Claims 1, 3-10, 12, 15-17, 19, 29, 31-32, 34, 37, 44, 50, 57, and 60-61 are not anticipated by Seet et al. (U.S. Patent Publication No. 2004/0131878, "Suto").

7. ARGUMENT

A. Claims 57-61 do not fail to comply with the written description requirement under 35 U.S.C. §112, first paragraph.

Appellant asserts that the rejection of claims 57-61 for failing to comply with the written description requirement under 35 U.S.C. §112, first paragraph is improper.

i. Prima Facie Case of No Written Description:

In order for the Examiner to establish a *prima facie* case of no written description Examiner must show the application does not reasonably describe or convey the concepts; to one of ordinary skill in the art, at the time the application was filed.¹ Adequate description under the first paragraph of 35 U.S.C. §112 does not require literal support for the claimed invention.² The fact that the exact words in question are not in the specification is not important.³ The Federal Circuit has held that the lack of explicit recitation of a particular phrase in the specification is not dispositive of the *prima facie* case.⁴ The Examiner has the initial burden of presenting evidence or reasons why persons skilled in the art would not recognize in the specification a description of the invention defined by the claims.⁵

After the application was filed, Appellant added new claims 57-61. Appellant added the new claims in an attempt to clarify the nature of the invention claimed by Appellant. Appellant cancelled claims 54-56 to place Appellant's application in condition for allowance in Appellant's response mailed 27 June 2006. Appellant added new claims 57-61 in Appellant's response mailed 27 November 2006 since cancellation of those claims did not result in allowance. Examiner in Examiner's Final Office action mailed 28 February 2007 rejected the newly added claims under 35 U.S.C. §112, first and second paragraphs. Appellant responded to those rejections in Appellant's response mailed 28 April 2007. Examiner in Examiner's Advisory Action mailed 17 May 2007 refused to consider Appellant's response because of non-compliance (claims 57 and 59-61 contained incorrect status identifiers); however, in the Advisory Action, Examiner stated "Applicant's arguments will be addressed when a compliant amendment is submitted." On 24 May 2007

¹ *Ex parte Parks*, 30 USPQ2d 1234, 1236 (B.P.A.I. 1994).

² *Id.*

³ *In re Wright*, 866 F.2d 422, 9 USPQ2d 1649 (Fed. Cir. 1989).

⁴ *Id.*

⁵ *Ex parte Sorenson*, 3 USPQ2d 1462, 1463 (B.P.A.I. 1987).

Appellant submitted a compliant amendment; however, as of the mailing date of this Appeal Brief Appellant has not received any response from the Examiner.

Appellant asserts that Examiner should have considered Appellant's arguments and enter either in whole or in part the amendments to the claims that would simplify the issues on appeal. Appellant asserts MPEP §714.13(III) states the refusal to enter the proposed amendment should not be arbitrary. The proposed amendment should be given sufficient consideration to determine whether the claims are in condition for allowance and/or whether the issues on appeal are simplified. Appellant asserts Examiner failed to give the proposed amendments sufficient consideration since arguably at least some of the amendments would have simplified the issues on appeal. However, Appellant recognizes the amended claim language of claims 58 and 60 is not being appealed but Appellant has presented the amended claim language in Appellant's arguments because Appellant believes that it provides further weight that the elements/limitations under appeal are clearly supported in the specification as well as presenting a clearer picture of the claims that should have been on Appeal.

ii. Independent claim 57 complies with the written description requirement under 35 U.S.C. §112, first paragraph

In regards to claim 57, claim 57 was not amended in Appellant's Responses mailed 24 May and 28 April 2007 and discloses "means for generating a difference in thermal conductivity laterally within an essentially uniformly thick tantalum layer disposed over said substrate," which Appellant asserts is discussed in the specification at least at page 2, paragraph [0008] of Appellant's specification which states "the present invention also provides a method of forming a single sheet of tantalum (i.e. essentially uniformly thick tantalum layer) in which the structural phase of tantalum is laterally switched (i.e. "switching-phase-tantalum") between α -phase tantalum and β -phase tantalum at length scales in the nanometer range. Further, alpha or bcc-phase tantalum has a thermal conductivity an order of magnitude

higher than β -phase tantalum, thus, the present invention provides a convenient method of generating surface temperature gradients by spatially controlling the phase of tantalum deposited over lateral length scales in the nanometer range." In addition, as Examiner has recognized and pointed out, paragraph [0021] also provides support for the claim limitation presented in claim 57 by disclosing "the creation of various patterns or structures of alpha and beta phases of tantalum also provides a means of generating thermal and electrical gradients in the same tantalum layer, both within the film thickness (i.e. vertically as illustrated in Fig. 2c) and laterally on the surface . . . of the tantalum layer. By utilizing tantalum structures having sub-micrometer dimensions thermal and electrical gradients in this length scale may be generated." Further, Appellant asserts that various embodiments disclosed within the specification provide further support since they can be used to generate a difference in thermal conductivity laterally within an essentially uniformly thick tantalum layer. Accordingly, Appellant asserts it is clear that claim 57 complies with the written description requirement under 35 U.S.C. §112, first paragraph. Therefore, Appellant asserts that Examiner's rejection of claim 57 for failing to comply with the written description requirement under 35 U.S.C. §112, first paragraph is improper.

iii. Dependent claims 58-61 complies with the written description requirement under 35 U.S.C. §112, first paragraph

In regards to claim 58, claim 58 discloses "means for heating a fluid, said means for heating disposed between said tantalum layer and said substrate," which Appellant asserts is discussed in the specification at least at page 11, paragraph [0023] of Applicant's specification which states, in describing Fig. 3, "fluid ejector head 300 includes bcc-phase tantalum region 334 providing environmental, mechanical, and electrical protection to resistor 343. In providing environmental and mechanical protection bcc-phase tantalum region 334 provides protection from cavitation when resistor 343 is activated forming a vapor bubble in fluid chamber 352

that rapidly expands expelling a fluid drop through nozzle or orifice 362 and then rapidly collapses back on the surface of bcc-phase tantalum region 334."

Accordingly Appellant asserts it is clear that claim 58 complies with the written description requirement under 35 U.S.C. §112, first paragraph. Therefore, Appellant asserts that Examiner's rejection of claim 58 for failing to comply with the written description requirement under 35 U.S.C. §112, first paragraph is improper. Further, Appellant originally thought in preparing Appellant's response to Examiner's Final Office action of 28 February 2007 that Examiner had misnumbered the rejection of claim 59 under 35 U.S.C. §112, second paragraph but, in preparing this Appeal Brief, Appellant realized that Examiner correctly rejected claim 59. Appellant notes that Appellant's amendment to claim 58 which consisted of adding the word "fluid" after heating to further clarify "means for heating" was not necessary and should not be entered. Appellant further asserts this does not effect Appellant's argument given above in regards to 35 U.S.C. §112, first paragraph.

In regards to claim 59, claim 59 was not amended in Appellant's Responses mailed 24 May and 28 April 2007 and discloses "means for electrically isolating said means for heating," which Appellant asserts is discussed in the specification at least at page 11, paragraph [0023] of Appellant's specification which states,

"optional substrate dielectric layer 340 is a silicon oxide layer disposed on substrate 320. However, in alternate embodiments, other materials also may be utilized, such as metals or polymers, depending on the particular substrate material used and the particular application in which fluid ejector head 300 will be used. In this embodiment, the thickness of substrate dielectric layer is in the range from about 0.40 micrometers to about 0.75 micrometers. However, in alternate embodiments, the thickness of substrate dielectric layer 340 may be in the range from about 0.10 micrometers to about 2 micrometers," as well as page 13 paragraph [0025] which discloses the "embodiment shown in Fig. 3 utilizes two dielectric passivation formed over thermal

resistor 343 and electrical conductors 344, first dielectric layer 346 disposed on thermal resistor 343 and electrical conductors 344, and second dielectric layer 348 disposed on first dielectric layer 346. In this embodiment, first dielectric layer 346 is a silicon nitride (Si_xN_y) layer and second dielectric layer 348 is a silicon carbide (SiC_x) layer. However, in alternate embodiments, a single dielectric layer also may be utilized. In addition, a wide variety of dielectric materials may be utilized to form the first and second dielectric layers. For example, silicon oxide (SiO_x), boron nitride (BN_x), aluminum oxide (Al_xO_y), tantalum oxide (Ta_xO_y), and high temperature polymers such as polyimide also may be utilized. Fluid ejector head 300 also includes bcc-phase-tantalum forming seed structure 324 disposed on second dielectric layer 348 in the region over fluid ejector actuator 310."

Accordingly, Appellant asserts it is clear that claim 59 complies with the written description requirement under 35 U.S.C. §112, first paragraph. Therefore, Appellant asserts that Examiner's rejection of claim 59 for failing to comply with the written description requirement under 35 U.S.C. §112, first paragraph is improper.

In regards to claim 60, claim 60 discloses "means for generating a difference in electrical conductivity laterally within an essentially uniformly thick tantalum layer disposed over said substrate," which Appellant asserts is discussed in the specification at least at page 10, paragraph [0021] of Appellant's specification, which Examiner has recognized and pointed out. Appellant asserts paragraph [0021] provides support for the claim limitation presented in claim 60 by disclosing "the creation of various patterns or structures of alpha and beta phases of tantalum also provides a means of generating thermal and electrical gradients in the same tantalum layer, both within the film thickness (i.e. vertically as illustrated in Fig. 2c) and laterally on the surface temperature of the tantalum layer. By utilizing tantalum structures having sub-micrometer dimensions thermal and electrical gradients in this length scale may be generated." Accordingly, Appellant asserts it is clear that

claim 60 complies with the written description requirement under 35 U.S.C. §112, first paragraph. Therefore, Appellant asserts that Examiner's rejection of claim 60 for failing to comply with the written description requirement under 35 U.S.C. §112, first paragraph is improper. Appellant notes claim 60 was amended by Appellant in Appellant's Responses mailed 24 May and 28 April 2007. However, Appellant asserts that the amendment did not amend the above element/limitation "means for generating a difference in electrical conductivity laterally within an essentially uniformly thick tantalum layer disposed over said substrate," and therefore does not effect Appellant's argument given above in regards to 35 U.S.C. §112, first paragraph.

In regards to claim 61, claim 61 was not amended in Appellant's Responses mailed 24 May and 28 April 2007 and discloses "wherein said essentially uniformly thick tantalum layer has an essentially uniform composition," Appellant asserts claim 61 is discussed in the specification at least at page 1, paragraph [0002] of Applicant's specification which states it "is well known that tantalum films may be produced in two different crystallographic phases, body-centered-cubic (bcc), commonly referred to as alpha tantalum (α -phase), and tetragonal, commonly referred to as beta tantalum (β -phase). Typically, the deposition of a high quality bcc tantalum film requires high quality vacuum systems having pressures less than 10^{-7} Torr, high deposition rates of greater than 1 nanometer per second, and elevated substrate temperatures of greater than 300 °C. On the other hand, β -phase tantalum generally is formed at higher pressures, lower deposition rates, and lower substrate temperatures. The ability to form both phases of tantalum under a common set of conditions will open up a wide variety of applications that are currently either impractical or are not cost effective." Accordingly, Appellant asserts it is clear that claim 61 complies with the written description requirement under 35 U.S.C. §112, first paragraph. Therefore, Appellant asserts that Examiner's rejection of claim 61 for failing to comply with the written description requirement under 35 U.S.C. §112, first paragraph is improper.

Thus, in regards to claims 57-61 Appellant asserts claims 57-61 clearly do comply with the written description requirement under 35 U.S.C. §112, first paragraph. Accordingly, the rejection of claims 57-61 under 35 U.S.C. §112, first paragraph is improper.

B. Claims 57-61 are not indefinite under 35 U.S.C. §112, second paragraph.

Appellant asserts that the rejection of claims 57-61 as being indefinite for failing to particularly point out and distinctly claim the subject matter which appellant regards as the invention under 35 U.S.C. §112, second paragraph is improper.

i. Prima Facie case of Indefiniteness

Appellant asserts Examiner has failed to establish a prima facie case of indefiniteness. Any rejection under 35 U.S.C. §112 second paragraph must show three elements in order to establish indefiniteness. First the claims, when read in view of the specification, are unclear. Second the claim language is unclear to one of ordinary skill in the art. And third the interpreted claim language is not reasonably defined. The Examiner bears the burden of providing evidence to support the rejection under §112. In rejecting a claim under the second paragraph of 35 U.S.C. §112, it is incumbent on the examiner to establish that one of ordinary skill in the pertinent art, when reading the claims in light of the supporting specification, would not have been able to ascertain with a reasonable degree of precision and particularity the particular area set out and circumscribed by the claims.⁶ In determining whether a claim is indefinite the examiner cannot reject a claim as indefinite merely because it poses a difficult issue of claim construction but rather

⁶ *Ex parte Wu.*, 10 USPQ2d 2031, 2033 (B.P.A.I. 1989) (citing *In re Moore*, 439 F.2d 1232, 169 USPQ 236 (C.C.P.A. 1971).

the examiner can only ask that the claims be amendable to construction, however difficult that task may be.⁷ It is well settled that the "language of claims, read in light of the specification" is to be considered when determining whether the claims are definite."⁸ The definiteness of the language employed must be analyzed not in a vacuum, but in light of the teachings of the prior art and of the particular application disclosure as it would be interpreted by one possessing the ordinary level of skill in the pertinent art.⁹ Appellant asserts that if the claims read in the light of the specification, reasonably apprise those skilled in the art both of the utilization and scope of the invention, and if the language is as precise as the subject matter permits the examiner can demand no more.¹⁰

ii. Independent claim 57 is not indefinite

Appellant asserts the response given above in regards to Examiner's rejection of independent claim 57 based on 35 U.S.C. §112 first paragraph is applicable to this rejection that claim 57 is indefinite. Examiner stated "it is unclear whether the entirety of the breadth of claim 57 is supported by paragraph 21." Examiner asked "[i]s the only 'means' that described at paragraph 21 of the specification?" Appellant is unsure why Examiner is asserting that it is unclear whether the entirety of the breadth claim 57 is supported by paragraph 21. Appellant argued above in regards to the 35 U.S.C. §112 first paragraph rejection that there is additional support in the specification for claim 57, which Appellant believes overcomes Examiner's rejection based on indefiniteness. In addition, Appellant points out that if Examiner is asserting that Appellant has a single element means-plus-function claim, Appellant believes that such an assertion is incorrect since claim 57 also includes the limitation of a substrate. Appellant asserts that the final paragraph of §112 "saves

⁷ *Exxon Research & Eng'g Co. v. United States*, 265 F.3d 1371, 60 USPQ2d 1272, 1282 (Fed. Cir. 2001).

⁸ *Allen Archery Inc. v. Browning Mfg. Co.*, 819 F.2d 1087, 2 USPQ2d 1490, 1494 (Fed. Cir. 1987).

⁹ *In re Angstadt*, 537 F.2d 498, 190 USPQ 214, 217 (C.C.P.A. 1976).

¹⁰ *North Am. Vaccine, Inc. v. American Cyanamid Co.*, 7 F.3d 157, 28 USPQ2d 1333, 1339 (Fed. Cir. 1993). *In re Angstadt*, 537 F.2d 498, 190 USPQ 214, 217 (C.C.P.A. 1976).

combination claims drafted using means-plus-function format from [the indefiniteness] problem by providing a construction of that format narrow enough to avoid the problem of undue breadth as forbidden by the first paragraph."¹¹ Further, Appellant argues that one needs only to recite some structure corresponding to the means in the specification, as the statute states, so that one can readily ascertain what the claim means and comply with the particularity requirement of Section 112, second paragraph. The Federal Circuit has not required a substantial or significant description to satisfy the requirement of corresponding structure" under §112, sixth paragraph and instead has stated "[I]f one employs means-plus-function language in a claim, one *must* set forth in the specification an adequate disclosure showing what is meant by the claim language."¹² Appellant asserts Examiner has admitted on the record that claim 57 is supported by paragraph 21, therefore, Appellant argues it is definite and Appellant is not required to do more to overcome an indefinite rejection. Appellant respectfully notes the use of a mere conclusory statement as Examiner has used does not provide Appellant any reasonable means of responding except to guess as to Examiner's reasoning or interpretation. Appellant believes to establish a *prima facie* case of indefiniteness Examiner must provide a more reasoned explanation, based on sound technical and scientific reasoning as to why Examiner believes paragraph 21 does not support the entirety of the breadth of claim 57 as currently presented. Accordingly, Appellant asserts it is clear that claim 57 is definite under 35 U.S.C. §112, second paragraph, or in the alternative Appellant asserts Examiner has not established a *prima facie* case of indefiniteness. Therefore, Appellant asserts that Examiner's rejection of claim 57 as being indefinite under 35 U.S.C. §112, second paragraph is improper.

¹¹ *In re Hyatt*, 708 f.2d 712, 715, 218 USPQ 195, 197 (Fed. Cir. 1983) (emphasis added).

¹² *Atmel Corp. v. Information Storage Devices Inc.*, 198 F.3d 1374, 1380, 53 USPQ2d 1225 (Fed. Cir. 1999).

iii. Dependent claims 58-61 are not indefinite

Appellant originally thought in preparing Appellant's response to Examiner's Final Office action of 28 February 2007 that Examiner had misnumbered the rejection of claim 59 but Appellant realized in preparing this Appeal Brief that Examiner correctly rejected claim 59. However, that then leaves claim 58 without any argument in support of Examiner's rejection of claim 58 as being indefinite under 35 U.S.C. §112, second paragraph. In reviewing claim 58 as originally presented Appellant is at this time unable to see any indefiniteness with the limitation "means for heating a fluid, said means for heating disposed between said tantalum layer and said substrate." As Appellant has argued above in regards to the rejection of claim 58 under 35 U.S.C. §112, first paragraph there is clear support in the specification for claim 58 as currently written. Accordingly, without more from the Examiner Appellant believes claim 58 is not indefinite. Therefore, Appellant asserts that Examiner's rejection of claim 58 as being indefinite under 35 U.S.C. §112, second paragraph is improper.

In regards to claim 59 Examiner stated "it is unclear what is the antecedent basis of the phrase "said means for heating" as there is no mention of heating in claim 57. Appellant agrees with Examiner. Appellant will amend claim 59 to properly depend from claim 58 where "said means for heating" does provide proper antecedent basis, if claim 59 is found to be allowable.

Appellant asserts the response given above in regards to Examiner's rejection of dependent claim 60 based on 35 U.S.C. §112 first paragraph is applicable to this rejection of claim 60 as being indefinite. In addition, Appellant asserts the response given above in regards to Examiner's rejection of independent claim 57 based on 35 U.S.C. §112 second paragraph also is applicable to this rejection of claim 60 as being indefinite. Further, Appellant believes that Appellant's amendment to claim 60 as presented in Appellant's responses of 28 April 2007 and 24 May 2007 should

have been considered by Examiner and entered because the amendment would have simplified the issues for appeal. Appellant asserts that Examiner should have considered Appellant's arguments and enter either in whole or in part the amendments to the claims that would simplify the issues on appeal. In particular, Appellant argues that the amendment to claim 60 should have been entered because Appellant's amendment directly addressed and Appellant believes cured the deficiencies Examiner asserted. The proposed language:

"The apparatus in accordance with claim 57, wherein said means for generating a difference in thermal conductivity laterally within an essentially uniformly thick tantalum layer ~~further comprising~~ includes means for generating a difference in electrical conductivity laterally within an essentially uniformly thick tantalum layer disposed over said substrate."

cures Examiner's concerns about the use of the word "further" since Appellant has deleted that word and has further clarified the limitation by adding the phrase "wherein said means for generating a difference in thermal conductivity laterally within an essentially uniformly thick tantalum layer." Appellant asserts MPEP §714.13(III) states the refusal to enter the proposed amendment should not be arbitrary. The proposed amendment should be given sufficient consideration to determine whether the claims are in condition for allowance and/or whether the issues on appeal are simplified. Appellant asserts Examiner failed to give the proposed amendment sufficient consideration since arguably at least the amendment of claim 60 would have simplified the issues on appeal. Appellant asserts that leaves only Examiner's rejection based on what is the full breadth of the meaning of claim 60 which Appellant asserts is address above in Appellant's arguments for claim 57 under 35 U.S.C. §112, second paragraph. In addition, Appellant argued above in regards to the 35 U.S.C. §112, first paragraph rejection that there is additional support in the specification for claim 60, which Appellant believes overcomes Examiner's rejection based on indefiniteness. Appellant asserts Examiner has admitted on the record that claim 60 is supported by paragraph 21, therefore, Appellant argues it is definite and Appellant is not required to do more to overcome an indefinite rejection. Appellant believes to establish a *prima facie* case

of indefiniteness Examiner must provide a more reasoned explanation, based on sound technical and scientific reasoning as to why Examiner believes paragraph 21 does not support the entirety of the breadth of claim 60 as currently presented. Accordingly, Appellant asserts it is clear that claim 60 is definite under 35 U.S.C. §112, second paragraph, or in the alternative Appellant asserts Examiner has not established a *prima facie* case of indefiniteness. Therefore, Appellant asserts that Examiner's rejection of claim 60 as being indefinite under 35 U.S.C. §112, second paragraph is improper.

In regards to claim 61 Appellant can only ask what about a uniform composition is unclear. Appellant believes the limitation is clear on its face. In addition, Appellant in regards to Appellant's arguments presented to overcome the 35 U.S.C. §112, first paragraph rejection are applicable to this rejection as well. There is clearly support in the specification for the limitation of a "uniform composition." Appellant asserts that "uniform composition" has the plain and ordinary meaning that the composition is uniform. Further, Appellant continues to disagree with Examiner that a uniform composition is unclear because the tantalum layer includes alpha and beta Ta in the layer. Appellant has no idea why Examiner is making such a statement and provides no reasoned explanation, based on sound technical and scientific reasoning why these two elements/limitations when claimed together are unclear. Appellant respectfully requested Examiner provide in Examiner's Advisory action some explanation as to what Examiner sees is unclear in regards to the limitation "a uniform composition," found in claim 61. Appellant at this time can only guess as to Examiner's reasoning that the mere presence of both phases of tantalum, alpha and beta, somehow makes a uniform composition unclear. Appellant believes to establish a *prima facie* case of indefiniteness Examiner must provide a more reasoned explanation, based on sound technical and scientific reasoning as to why Examiner believes the limitation "uniform composition" is unclear because both phases of tantalum are present. Accordingly, Appellant asserts it is clear that claim 61 is definite under 35 U.S.C. §112, second paragraph,

or in the alternative Appellant asserts Examiner has not established a *prima facie* case of indefiniteness. Therefore, Appellant asserts that Examiner's rejection of claim 61 as being indefinite under 35 U.S.C. §112, second paragraph is improper

Thus, in regards to claims 57-61 Appellant asserts claims 57-61 clearly are definite and do comply with 35 U.S.C. §112, second paragraph. Accordingly, the rejection of claims 57-61 under 35 U.S.C. §112, second paragraph is improper.

C. Claims 1, 3-10, 12, 15-17, 19, 29, 31-32, 34, 37, 44, 50, 57, and 60-61 are not anticipated by Seet et al. (U.S. Patent Publication No. 2004/0131878, "Seet").

Appellant asserts that the rejection of claims 1, 3-10, 12, 15-17, 19, 29, 31-32, 34, 37, 44, 50, 57, and 60-61 under 35 U.S.C. §102(e) as being anticipated by Seet et al. (U.S. Patent Publication No. 2004/0131878, "Seet") is improper.

i. Prima Facie case of Anticipation

In order for the Examiner to establish a *prima facie* case of anticipation there must be a single reference that teaches each of the claimed elements (arranged as in the claim) expressly or inherently as interpreted by one of ordinary skill in the art.¹³ In particular, an anticipation analysis must be conducted on a limitation by limitation basis, with specific fact findings for each contested limitation and satisfactory explanations for such findings.¹⁴ Anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed

¹³ MPEP 2131, ("A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference.). In addition, the identical invention must be shown in as complete detail as is contained in the . . . claim. MPEP 2131 citing *Richardson v. Suzuki Motor Co.*, 868 F.2d 1226 (Fed. Cir. 1990).

¹⁴ *Getcher v. Davidson*, 116 F.3d 1454, 43 USPQ2d 1030, 1035 (Fed. Cir. 1997).

invention arranged as in the claim.¹⁵ There must be no difference between the claimed invention and the reference disclosure, as viewed by a person of ordinary skill in the field of the invention.¹⁶ Thus, Appellant asserts it is well settled that a claim is anticipated if, and only if, each and every limitation set forth in the claim can be found expressly or inherently in a single piece of prior art. Furthermore, it is also well settled that the burden of establishing a prima facie case of anticipation resides with the Patent and Trademark Office.¹⁷

Examiner's rejection of independent claims 1, 50, and 57 and dependent claims 3-10, 12, 15-17, 19, 29, 31-32, 34, 37, 44, and 60-61 as being anticipated by Seet is based on the improper paraphrasing of the elements/limitations found in the claims without apparently conducting a limitation by limitation basis, with specific fact findings for each contested limitation and satisfactory explanations for such findings as required and noted above in regards to *Getcher v. Davidson*.

ii. Anticipation of independent claim 1 and dependent claims 3-10, 12, 15-17, 19, 29, 31-32, 34, 37, and 44

Appellant continues to argue Seet does not anticipate Appellant's independent claim 1. Independent claim 1, discloses

"a method of making a tantalum structure, "comprising creating a tantalum layer disposed on a first layer region of a first layer and on a second layer region of a second layer, wherein said tantalum layer is a substantially bcc-phase tantalum region on said first layer region and said tantalum layer is a non-bcc-phase tantalum region on said second layer region."

¹⁵ *Lindemann Maschinenfabrik GmbH v. American Hoist & Derrick Co.*, 730 F.2d 1452, 221 USPQ 481, 485 (Fed. Cir. 1984) (citing *Connell v. Sears Roebuck & Co.*, 722 F.2d 1542, 220 USPQ 193 (Fed. Cir. 1983)).

¹⁶ *Scripps Clinic & Research Found. v. Genentech Inc.*, 927 F.2d 1565, 18 USPQ2d 1001, 1010 (Fed. Cir. 1991).

¹⁷ *In re Skinner*, 2 USPQ2d 1788, 1788-89 (B.P.A.I. 1986).

In contrast, Seet discloses a method of making a mixed phase Ta layer 108 that is comprised of alpha phase Ta and beta phase Ta,¹⁸ and a method of making a beta phase Ta layer.¹⁹ Appellant notes Examiner in Examiner's Office action mailed 26 July 2006 stated

"Seet et al. teaches forming a copper layer coated with a tantalum layer comprised of bcc and non-bcc tantalum in contiguous relationship, wherein the tantalum layer is further coated with a copper layer. See Seet et al. (paragraphs 67-92). The second layer may be identified with regions of the lower copper layer that form non-bcc Ta or with the copper overlayer which covers non-bcc Ta."

Appellant argues this fails to establish a *prima facie* case of anticipation for several reasons. First, Appellant notes that paragraphs 67-92 actually cover portions of two separate and distinct example embodiments of the invention. Paragraphs 67-82 describe a portion of "First Example Embodiment of the Invention,"²⁰ and paragraphs 83-92 describe a portion of "Second Example Embodiment of the Invention."²¹ The first example is a process that does not require a pre-clean step before Ta deposition but does utilize a cooling step before Ta deposition, whereas the second example utilizes a pre-clean step before Ta deposition and does not utilize a cooling step before Ta deposition. Appellant is unsure why Examiner has cited paragraphs 67-92. If Examiner is relying on paragraphs 83-92 Appellant asserts depending on how Examiner is utilizing paragraphs 83-92 Examiner most likely has failed to establish a *prima facie* case of anticipation because Appellant asserts the two examples are separate and distinct and not readily combinable since Seet, as best Appellant has been able to determine does not suggest combining the processes, and even if combined there is nothing in Seet that teaches the results would be any different compared to each process being carried out separately as disclosed..

Second, Appellant asserts Examiner has failed to establish a *prima facie* case of anticipation because Examiner has failed to conduct a limitation by limitation

¹⁸ See page 4, paragraph 67.

¹⁹ See page 6, paragraph 110.

²⁰ Page 2, paragraph 41.

²¹ Page 4, paragraph 83.

analysis, with specific fact findings for each contested limitation and has failed to provide satisfactory explanations for such findings as required and noted above in regards to *Getcher v. Davidson*. Appellant argues it is clear from Examiner's argument above that Examiner has loosely paraphrased Appellant's claimed invention in describing how Seet anticipates all of the limitations of claims 1, 3-10, 12, 15-17, 19, 29, 31-32, 34, 37, 44, 50, 57, and 60-61 in a single paragraph. Examiner has not even cited all of the claim limitations of claim 1 let alone provided any explanation how the dependent claims are anticipated. Examiner in response to Appellant's arguments states, in the Final Office action, mailed 28 February 2007, "[w]ith respect to Claim 1, Seet teaches mixed phase Ta Layer, wherein the first layer is the copper underlayer and the second layer is the copper overlayer," without any further explanation addressing the issues raised by Appellant in Appellant's response mailed 27 November 2006. Appellant asserts that Appellant is left to guess as to Examiner's reasoning and interpretation. Appellant respectfully declines to guess as to Examiner's reasoning and interpretation and instead argues clearly Examiner has failed to establish a *prima facie* case of anticipation. Therefore, for this reason alone Appellant argues Examiner's anticipation rejection of claims 1, 3-10, 12, 15-17, 19, 29, 31-32, 34, 37, 44, and 50 based on Seet is improper.

Appellant further argues that Examiner's statement "Seet et al. teaches forming a copper layer coated with a tantalum layer comprised of bcc and non-bcc tantalum in contiguous relationship, wherein the tantalum layer is further coated with a copper layer," although not technically incorrect, fails to point out a significant teaching of Seet since Appellant asserts Seet specifically teaches a mixed phase Ta layer. Appellant asserts that Seet in fact teaches "[t]he Ta layer 108 is comprised of alpha phase Ta and beta phase Ta." Page 4, paragraph 67. Appellant has also previously noted that Seet discloses the "Ta layer is preferably comprised of alpha phase Ta with between 35-50 wt % and Beta phase Ta wt % between 50-65." Page 4, paragraph 71. On the same page in paragraph 82 Seet discloses that in "this embodiment, a mixed phase of alpha Ta and beta Ta are formed." Appellant asserts

that one of ordinary skill in the art of thin film deposition would readily understand that a mixed phase of alpha Ta and beta Ta means that the two phases are spatially randomly distributed phases of alpha Ta and beta Ta throughout the Ta film. This is further highlighted by Seet in teaching "[i]n this embodiment [referring to the first example] a mixed phase of alpha Ta and beta Ta are formed. Beta-Ta lattice (002) distance mismatch with Cu (111) becomes more pronounced and (110) alpha Ta crystalline growth becomes competitive to the (002) Beta Ta formation on a cooler substrate." Page 4, paragraph 82. Appellant asserts clearly Seet is teaching that the dominant phase is beta phase Ta but if one cools the substrate alpha phase Ta can become competitive with the beta phase and so one will end up with a mixed phase Ta layer that will have a lower resistivity than just a beta phase Ta layer. Once it is recognized that Seet teaches a mixed phase Ta layer, composed of alpha and beta phases; then Appellant argues that Examiner's second sentence, "[t]he second layer may be identified with regions of the lower copper layer that form non-bcc Ta or with the copper overlayer which covers non-bcc Ta," becomes an unreasonable interpretation of Appellant's claim language. Appellant argues both the lower copper layer and upper copper layer (i.e. copper overlayer) have an equal distribution of alpha and beta tantalum in contradistinction of Appellant's independent claim 1.

That is under Examiner's reasoning the first layer region of a first layer may be either the lower copper layer or it may be the copper overlayer since both layers have an equal distribution of alpha and beta phases. This is clearly an unreasonable interpretation because the opposite is also true the second layer region of the second layer also may be either the lower copper layer or it may be the copper overlayer. Appellant argues under Examiner's reasoning both the first layer region and second layer regions are not separately defined without the tantalum layer since Examiner is implying that a beta phase Ta grain will be found somewhere on one layer say arbitrarily the lower copper layer and this will then be defined as the first layer region, and likewise an alpha phase Ta grain will be found somewhere on

the second or copper overlay and this will then be defined as the second layer region. Clearly both layers have equal distribution of alpha grains and beta grains and therefore Examiner is for all practical purposes making Appellant's limitations arbitrary. In fact Appellant notes Examiner in response to Appellant's arguments states, in the Final Office action, mailed 28 February 2007, "[w]ith respect to Claim 1, Seet teaches mixed phase Ta Layer, wherein the first layer is the copper underlayer and the second layer is the copper overlayer." Appellant can only ask why is the first layer the copper underlayer and not the copper overlayer since both copper layers have both alpha phase and beta phase grains present. Appellant asserts such an interpretation Appellant argues is unreasonable and improper. Therefore, for this reason alone Appellant argues Examiner's anticipation rejection of claim 1 based on Seet is improper.

Appellant also asserts if one analyzes Examiner's assertion at small length scales Examiner's reasoning will fail. At length scales where the length and width of the first layer region approaches the grain size of the alpha and beta Ta phases the presence of either a grain of alpha phase Ta or a grain of beta phase Ta will depend solely on random nucleation and growth events, thus there is a strong likelihood or at least a reasonable likelihood that a grain of beta phase Ta will form on the copper underlayer and this beta phase Ta will be the only Ta phase present since the size of the first layer region is approximately the grain size of the Ta layer. Likewise in this example there is a strong likelihood or at least a reasonable likelihood that a grain of alpha phase Ta will be found in contact with the copper overlayer (in this case nothing is formed since the copper overlayer is deposited after the Ta deposition has taken place) and this alpha phase Ta will be the only Ta phase present since the size of the second layer region is also approximately the grain size of the Ta layer. Both of these examples are in contradistinction to what Examiner has asserted in response to Appellant's arguments in the Final Office action where Examiner clearly states the first layer is the copper underlayer and the second layer is the copper overlayer. Thus, Appellant asserts Seet cannot teach what Examiner

asserts. Therefore, for this reason alone Appellant argues Examiner's anticipation rejection of claim 1 based on Seet is improper.

Thus, contrary to Examiner's assertion Seet does not disclose creating a tantalum layer disposed on a first layer region of a first layer and on a second layer region of a second layer, wherein said tantalum layer is a substantially bcc-phase tantalum region on said first layer region and said tantalum layer is a non-bcc-phase tantalum region on said second layer region. Appellant continues to assert that Seet in disclosing a mixed phase Ta layer is in contradistinction to Appellant's claimed invention including a first layer region having a substantially bcc phase Ta region and a second layer region having non-bcc phase Ta region. Appellant is unaware of any distinguishing feature disclosed in Seet that in the case of a mixed phase Ta layer there is any crystallographic structural difference of the Ta layer at either the top or bottom copper surface. Appellant is left to guess as to why Examiner believes such a disclosure discloses a tantalum layer having a substantially bcc-phase tantalum region on a first layer region of a first layer and a non-bcc tantalum region on a second layer region of a second layer. This is especially true since Seet discloses that the mixed phase Ta layer having between 35 and 50 wt % alpha phase Ta and between 50 to 65 wt % beta phase Ta. Appellant can only ask is Examiner clearly asserting that 50 weight percent of alpha Ta rises to the level of anticipating a claim limitation stating "a substantially bcc-phase tantalum region." Therefore, for this reason alone Appellant argues Examiner's anticipation rejection of claim 1 based on Seet is improper.

Appellant also argues claim 1 claims "creating a tantalum layer disposed on . . . a first layer and on . . . a second layer. Appellant argues the plain ordinary meaning of "on" is to indicate position over and in contact with that which supports from beneath. Appellant notes as clearly shown in Fig. 2c metal layer 34 is formed over the Ta barrier layer 24. Thus, Seet discloses a mixed phase Ta layer disposed on the copper layer 13 and a metal layer 34 disposed over or on the mixed phase Ta

layer, e.g. the second layer, metal layer 34, is over or above the Ta layer in contradiction to the plain ordinary meaning of "on" as used in Appellant's claim 1. Therefore, for this reason alone Appellant argues Examiner's anticipation rejection of claim 1 based on Seet is improper.

In addition, in regards to dependent claim 3, claim 3 discloses "wherein creating said tantalum layer comprises creating said substantially bcc-phase tantalum region in contact with said non-bcc-phase tantalum region." Appellant previously asserted that for the same reasons that Seet does not anticipate claim 1 Seet does not anticipate claim 3 since the creation of a mixed phase Ta layer does not disclose wherein creating said tantalum layer comprises creating said substantially bcc-phase tantalum region in contact with said non-bcc-phase tantalum region. Examiner has responded, in the Final Office action, mailed 28 February 2007, that contacted is a respective region localized on opposite sides in the thickness direction. Appellant, argues this neither addresses the issues presented nor does it cure any of the deficiencies of Seet. Appellant asserts Examiner has failed to establish a *prima facie* case of anticipation because Examiner has failed to conduct a limitation by limitation analysis, with specific fact findings for each contested limitation and has failed to provide satisfactory explanations for such findings as required and noted above in regards to *Getcher v. Davidson*. Appellant notes Examiner has provided no explanation in the record as to the reasons for rejection of claim 3 except for responding that contacted is a respective region localized on opposite sides in the thickness direction. Therefore, for these reasons Appellant argues Examiner's anticipation rejection of claim 3 based on Seet is improper

In regards to dependent claim 4, claim 4 discloses "wherein creating said tantalum layer comprises creating said tantalum layer wherein said substantially bcc-phase tantalum region and said non-bcc-phase tantalum region are contiguous and form a continuous tantalum film." Appellant asserts that for the same reasons that

Seet does not anticipate claim 1 Seet does not anticipate claim 4 since the creation of a mixed phase Ta layer does not disclose wherein creating said tantalum layer comprises creating said tantalum layer wherein said substantially bcc-phase tantalum region and said non-bcc-phase tantalum region are contiguous and form a continuous tantalum film. Examiner has responded, in the Final Office action, mailed 28 February 2007, that "contiguous regions are respective regions localized on opposite sides in the thickness direction." Appellant, argues this neither addresses the issues presented nor does it cure any of the deficiencies of Seet. Appellant asserts Examiner has failed to establish a *prima facie* case of anticipation because Examiner has failed to conduct a limitation by limitation analysis, with specific fact findings for each contested limitation and has failed to provide satisfactory explanations for such findings as required and noted above in regards to *Getcher v. Davidson*. Appellant notes Examiner has provided no explanation in the record as to the reasons for rejection of claim 3 except for responding that "contiguous regions are respective regions localized on opposite sides in the thickness direction." Therefore, for these reasons Appellant argues Examiner's anticipation rejection of claim 4 based on Seet is improper.

In regards to dependent claim 12, claim 12 discloses "wherein creating said bcc-phase-tantalum forming first layer comprises creating said bcc-phase-tantalum forming first layer disposed on a sacrificial layer." Appellant has been unable to find anywhere within Seet the disclosure of the use of a sacrificial layer. Appellant respectfully requested that Examiner particularly point out where in Seet such a disclosure is made in Appellant's response mailed 27 Nov. 2006. Examiner in Examiner's Final Office action mailed 28 February 2007 stated "layer 10 in Figure 2C may be sacrificed. Appellant asserts this rejection is improper. It is clear Examiner is admitting on the record that Seet does not expressly disclose layer 10 is a sacrificial layer since Examiner has provided no reference within the text of Seet so disclosing and Examiner uses the wording "may be sacrificed" indicating an opinion that layer 10 in hindsight could be sacrificial. Appellant argues that

Examiner's hindsight opinion is not sufficient to establish a *prima facie* case of anticipation. If Seet does not expressly disclose the subject matter claimed then Examiner's only recourse for an anticipation rejection is to assert that Seet inherently discloses Appellant's claimed subject matter in question.

To establish inherency, the extrinsic evidence "must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill."²² Even the fact that a prior art reference is capable of being modified and the modification would anticipate the invention is not sufficient to support an anticipation rejection based on inherency.²³ Appellant further argues that if the reference inherently discloses the claimed subject matter then the prior art must make clear that a sacrificial layer is necessarily present and it must not require any modification of the prior art reference. Appellant asserts in this case neither requirement is met. Appellant argues there is simply nothing in the record to establish that Seet inherently discloses that the substrate may be a sacrificial layer. In fact, Appellant asserts that to make the substrate sacrificial would be to invalidate the very purpose of the invention of Seet. Namely Seet relates generally to fabrication of semiconductor devices such as ultra-large scale integrated (ULSI) devices where new interconnect schemes and materials are essential. Appellant asserts to remove the semiconductor substrate would make the very reason for the deposition of Ta film moot since once the semiconductor substrate is sacrificed, i.e. removed there is nothing for the interconnect scheme to electrically connect to. Therefore, for these reasons Appellant argues Examiner's anticipation rejection of claim 12 based on Seet is improper.

²² *Continental Can Co. USA v. Monsanto Co.*, 948 F.2d 1264, 1268, 20 USPQ2d 1746, 1749 (Fed. Cir. 1991).

²³ *Id.* at 1269, 20 USPQ2d at 1749 (quoting *In re Oelrich*, 666 F.2d 578, 581, 212 USPQ 323, 326 (C.C.P.A. 1981).

In regards to dependent claim 16, claim 16 discloses "wherein creating said first layer comprises creating a bcc-phase-tantalum forming substrate, wherein said second layer is disposed over said bcc-phase-tantalum forming substrate." Appellant previously noted that Appellant was unable to find anywhere within Seet the disclosure of the use of a bcc-phase-tantalum forming substrate. In Appellant's response mailed 27 November 2006, Appellant respectfully requested Examiner particularly point out where in Seet such a disclosure is made. Examiner in Examiner's Final Office action mailed 28 February 2007 stated "the second copper layer is over the substrate of layer 10, over the copper layer 13, and over the Ta layer 24." Appellant has no idea how this statement addresses the issue of Seet disclosing the use of a bcc-phase-tantalum forming substrate. Appellant asserts Examiner has failed to establish a *prima facie* case of anticipation because Examiner has failed to conduct a limitation by limitation analysis, with specific fact findings for each contested limitation and has failed to provide satisfactory explanations for such findings as required and noted above in regards to *Getcher v. Davidson*. Appellant notes Examiner has provided no explanation in the record as to the reasons for rejection of claim 12 except for responding with the statement presented above, which Appellant asserts seems on its face to be unconnected with the rejection at hand." Therefore, for these reasons Appellant argues Examiner's anticipation rejection of claim 12 based on Seet is improper.

Appellant asserts that Examiner has not provided a *prima facie* case of anticipation because clearly Seet does not disclose all of the elements/limitations of independent claim 1 and dependent claims 3-10, 12, 15-17, 19, 29, 31-32, 34, 37, and 44, and therefore the elements/limitations of independent claim 1 and dependent claims 3-10, 12, 15-17, 19, 29, 31-32, 34, 37, and 44 are arranged in a manner distinct from that disclosed in Seet. Accordingly, Appellant asserts the rejection of independent claim 1 and dependent claims 3-10, 12, 15-17, 19, 29, 31-32, 34, 37, and 44 under 35 U.S.C. §102(b) in respect to Seet is improper.

iii. Anticipation of independent claim 50

Appellant continues to argue Seet does not anticipate Appellant's independent claim 50. Independent claim 50, discloses

"an apparatus, comprising:
a substrate;
a tantalum layer disposed over said substrate; and
a bcc-phase-tantalum forming seed region disposed between said substrate and said tantalum layer, said bcc-phase-tantalum forming seed region in contact with said tantalum layer, **wherein said tantalum layer forms a substantially bcc-phase tantalum region where said tantalum layer is in contact with said bcc-phase-tantalum forming seed region**, and wherein said tantalum layer forms a non-bcc-phase tantalum region where said tantalum layer is **not in contact** with said bcc-phase tantalum forming seed region." *Emphasis added.*

For the same reasons as discussed above for independent claim 1 Appellant argues claim 50 is not anticipated by Seet. Appellant asserts Examiner has failed to establish a *prima facie* case of anticipation because Examiner has failed to conduct a limitation by limitation analysis, with specific fact findings for each contested limitation and has failed to provide satisfactory explanations for such findings as required and noted above in regards to *Getcher v. Davidson*. As Appellant has argued above in regards to claim 1 it is clear from Examiner's argument presented in Examiner's Office action mailed 26 July 2006 that Examiner has not even mentioned the majority of the claim limitations disclosed in claim 50. Examiner, in Examiner's Final Office action mailed 28 February 2007, in response to Appellant's arguments stated "Seet teaches in Figure 2C the presence of a copper seed layer in making layer 34 and teaches a barrier layer 16 that is interposed between 14 and 24 of the mixed phase Ta layer. Appellant notes that claim 50 claims a bcc-phase-tantalum forming seed region. Appellant has found in paragraph 38 Seet disclosing the first embodiment "does not require a seed layer" Again in paragraph 81 Seet discloses the lack of a seed layer for the first embodiment. In paragraph 105 Seet discloses in regards to Fig. 2C a PVD Cu seed and electrochemical plated Cu or Cu alloy. Appellant argues in this case the PVD Cu seed is for electroplating and is not related to a bcc-phase-tantalum forming seed region. And in paragraph 119 the

term "Cu seed" is disclosed by Seet, which Appellant asserts is related to an embodiment where the Ta layer is a beta phase Ta. Paragraph 122 of Seet does disclose "a first layer (seed layer) of TaN is deposited followed by a Ta Layer," but only in reference to a commercial PVD tool and Seet does not disclose, as best Appellant has been able to determine, the use of a TaN layer in any of its embodiments. Finally, paragraph 141 of Seet discloses "alpha phase Ta can form on top of TaN seed layer." Appellant asserts that none of these disclosures anticipates the entirety of claim 50. That this is so is made clear when one considers Appellant's claim limitation "wherein said tantalum layer forms a non-bcc-phase tantalum region where said tantalum layer is **not in contact** with said bcc-phase tantalum forming seed region." Examiner has stated that the copper underlayer is the bcc-phase-tantalum forming seed region and the copper overlayer is the non-bcc-phase tantalum region. Given this structure as previously argue alpha and beta phase grains are in contact with both copper layers. Therefore, Examiner's interpretation is clearly incorrect. Therefore, for these reasons Appellant argues Examiner's anticipation rejection of independent claim 50 based on Seet is improper.

Appellant asserts that Examiner has not provided a *prima facie* case of anticipation because clearly Seet does not disclose all of the elements/limitations of independent claim 50 and therefore the elements/limitations of independent claim 50 are arranged in a manner distinct from that disclosed in Seet. Accordingly, Appellant asserts the rejection of independent claim 50 under 35 U.S.C. §102(b) in respect to Seet is improper.

iii. Anticipation of independent claim 57 and dependent claims 60 and 61.

Appellant continues to argue Seet does not anticipate Appellant's independent claim 57. Independent claim 57, discloses an apparatus, "comprising:

a substrate; and means for generating a difference in thermal conductivity laterally within an essentially uniformly thick tantalum layer disposed over said substrate." For the same reasons as discussed above for independent claim 1 Appellant argues claim 50 is not anticipated by Seet. Appellant asserts Examiner has failed to establish a *prima facie* case of anticipation because Examiner has failed to conduct a limitation by limitation analysis, with specific fact findings for each contested limitation and has failed to provide satisfactory explanations for such findings as required and noted above in regards to *Getcher v. Davidson*. Examiner, in Examiner's Final Office action mailed 28 February 2007, stated as the reasons for rejecting claim 57 "Seet also teaches the that the tantalum layer is comprised of alpha and beta Ta, which applicant has explained gives rise to differences in thermal conductivity and electrical conductivity. Therefore, on the dimension scale of these different phases, as one moves laterally across the layer it would be expected that the claimed variation in thermal and electrical conductivity would be observable." As Examiner is stating only within an isolated grain can Examiner's statement even possibly be asserted. Over any distance larger than a single grain the thermal and electrical conductivity will be averaged over the number of grains and thus will not result in any difference in thermal and electrical conductivity because of the random distribution unlike Appellant's claimed invention. Since as argued above the mixed phase Ta layer disclosed in Seet appears to be a random mixture then the thermal and electrical conductivities will likewise have an average value based on the number of grains of each phase present. Appellants assert that such an interpretation by Examiner is unreasonable and one of ordinary skill in the art would not read Seet to teach Appellant's claimed invention as claimed in claim 57. Appellants also note that all of these arguments are equally applicable to claim 60 since claim 60 discloses "means for generating a difference in electrical conductivity laterally within an essentially uniform thick tantalum layer disposed over said substrate," since differences in electrical conductivity as disclosed by Seet would be limited to differences between one grain and another. Therefore, for these reasons

Appellant argues Examiner's anticipation rejection of independent claim 57 and dependent claim 60 based on Seet is improper

Appellant asserts that Examiner has not provided a *prima facie* case of anticipation because clearly Seet does not disclose all of the elements/limitations of independent claim 57 and dependent claim 60 and therefore the elements/limitations of independent claim 50 and dependent claim 60 are arranged in a manner distinct from that disclosed in Seet. Accordingly, Appellant asserts the rejection of independent claim 50 and dependent claim 60 under 35 U.S.C. §102(b) in respect to Seet is improper.

Conclusion

The Examiner failed to establish a *prima facie* case of failure to comply with the written description requirement under 35 U.S.C. §112, first paragraph for claims 57-61. Appellant has shown that the elements/limitations of claims 57-61 are supported in the specification. Appellant respectfully requests that the Board reverse the Examiner's final rejection and promptly allow claims 57-61.

The Examiner failed to establish a *prima facie* case of indefiniteness under 35 U.S.C. §112, second paragraph for claims 57-61. Appellant has shown that the elements/limitations of claims 57-61 are definite under 35 U.S.C. §112, second paragraph. Appellant respectfully requests that the Board reverse the Examiner's final rejection and promptly allow claims 57-61

The Examiner failed to establish a *prima facie* case of anticipation for claims 1, 3-10, 12, 15-17, 19, 29, 31-32, 34, 37, 44, 50, 57, and 60-61. Appellant has shown that Seet does not disclose all of the elements/limitations disclosed in claims 1, 3-10, 12, 15-17, 19, 29, 31-32, 34, 37, 44, 50, 57, and 60-61. Appellant respectfully requests that the Board reverse the Examiner's final rejection and

promptly allow claims 1, 3-10, 12, 15-17, 19, 29, 31-32, 34, 37, 44, 50, 57, and 60-61.

Appellant respectfully requests the timely issuance of a notice of allowance indicating that claims 1-53 and 57-61 are allowed.

Appellant will defer their decision as to whether or not to request oral argument until after receipt of the Examiner's Answer to this Appeal Brief.

8. Claims Appendix

Listing of claims:

1. (Original) A method of making a tantalum structure, comprising creating a tantalum layer disposed on a first layer region of a first layer and on a second layer region of a second layer, wherein said tantalum layer is a substantially bcc-phase tantalum region on said first layer region and said tantalum layer is a non-bcc-phase tantalum region on said second layer region.

2. (Objected to)

3. (Previously presented) The method in accordance with claim 1, wherein creating said tantalum layer comprises creating said substantially bcc-phase tantalum region in contact with said non-bcc-phase tantalum region.

4. (Previously presented) The method in accordance with claim 1, wherein creating said tantalum layer comprises creating said tantalum layer wherein said substantially bcc-phase tantalum region and said non-bcc-phase tantalum region are contiguous and form a continuous tantalum film.

5. (Previously presented) The method in accordance with claim 1, further comprising:

forming said first layer region over a substrate; and
forming said second layer region over said substrate.

6. (Previously presented) The method in accordance with claim 5, wherein forming said first layer region comprises forming a bcc-phase-tantalum forming region disposed over or on said second layer.

7. (Original) An apparatus manufactured in accordance with claim 6.
8. (Original) The method in accordance with claim 1, further comprising creating said first layer.
9. (Previously presented) The method in accordance with claim 8, wherein creating said first layer comprises creating a bcc-phase-tantalum forming first layer as said first layer.
10. (Previously presented) The method in accordance with claim 9, wherein creating said bcc-phase-tantalum forming first layer comprises sputter depositing or chemically vapor depositing, or both, said bcc-phase-tantalum forming first layer.
11. (Objected to)
12. (Previously presented) The method in accordance with claim 9, wherein creating said bcc-phase-tantalum forming first layer comprises creating said bcc-phase-tantalum forming first layer disposed on a sacrificial layer.
13. (Objected to)
14. (Objected to)
15. (Previously presented) The method in accordance with claim 9, wherein creating said bcc-phase-tantalum forming first layer comprises depositing said bcc-phase-tantalum forming first layer utilizing a deposition technique selected from the group consisting of sputtering, laser ablation, electron beam evaporation, thermal evaporation, electro-deposition, electroless deposition, chemical vapor deposition, and combinations thereof.

16. (Previously presented) The method in accordance with claim 8, wherein creating said first layer comprises creating a bcc-phase-tantalum forming substrate, wherein said second layer is disposed over said bcc-phase-tantalum forming substrate.

17. (Original) The method in accordance with claim 16, further comprising depositing said second layer over said bcc-phase-tantalum forming substrate.

18. (Objected to)

19. (Original) The method in accordance with claim 1, further comprising creating said second layer, wherein said second layer is a substrate.

20. (Objected to)

21. (Objected to)

22. (Objected to)

23. (Objected to)

24. (Objected to)

25. (Objected to)

26. (Objected to)

27. (Objected to)

28. (Objected to)

29. (Original) The method in accordance with claim 1, further comprising cleaning said first layer region before creating said tantalum layer.

30. (Objected to)

31. (Previously presented) The method in accordance with claim 29, wherein cleaning said first layer region comprises sputter pre-cleaning said first layer region.

32. (Previously presented) The method in accordance with claim 31, wherein sputter pre-cleaning comprises sputter cleaning said first layer region utilizing an inert gas.

33. (Objected to)

34. (Original) The method in accordance with claim 1, further comprising creating said second layer.

35. (Objected to)

36. (Objected to)

37. (Original) The method in accordance with claim 1, further comprising creating a resistor layer disposed between a substrate and said first layer.

38. (Objected to)

39. (Objected to)

40. (Objected to)

41. (Objected to)
42. (Objected to)
43. (Objected to)
44. (Original) An apparatus manufactured in accordance with claim 1.
45. (Objected to)
46. (Objected to)
47. (Objected to)
48. (Objected to).
49. (Allowed)
50. (Previously presented) An apparatus, comprising:
a substrate;
a tantalum layer disposed over said substrate; and
a bcc-phase-tantalum forming seed region disposed between said substrate and said tantalum layer, said bcc-phase-tantalum forming seed region in contact with said tantalum layer, wherein said tantalum layer forms a substantially bcc-phase tantalum region where said tantalum layer is in contact with said bcc-phase-tantalum forming seed region, and wherein said tantalum layer forms a non-bcc-phase tantalum region where said tantalum layer is not in contact with said bcc-phase tantalum forming seed region.

51. (Objected to)

52. (Objected to)

53. (Objected to)

54-56. (Cancelled)

57. (Previously presented) An apparatus, comprising:
a substrate; and
means for generating a difference in thermal conductivity laterally within an essentially uniformly thick tantalum layer disposed over said substrate.

58. (Previously presented) The apparatus in accordance with claim 57, further comprising means for heating a fluid, said means for heating disposed between said tantalum layer and said substrate.

59. (Previously presented) The apparatus in accordance with claim 57, further comprising means for electrically isolating said means for heating.

60. (Previously presented) The apparatus in accordance with claim 57, further comprising means for generating a difference in electrical conductivity laterally within an essentially uniformly thick tantalum layer disposed over said substrate.

61. (Previously presented) The apparatus in accordance with claim 57 wherein said essentially uniformly thick tantalum layer has an essentially uniform composition.

9. EVIDENCE APPENDIX

None presented.

10. RELATED PROCEEDINGS APPENDIX

None presented.

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